

CLAIMS

- 1) A semiconductor emitter/detector optical device comprising a single substrate arranged for emitting light for incidence on a sample or other element and also responsive to light
5 received from said sample or other element, the device further comprising means for monitoring a characteristic of the device which varies in dependence upon said light received from said sample or other element.
- 2) A device as claimed in claim 1, arranged such that said
10 received light affects an electrical property thereof and so alters its current-voltage characteristic, said monitoring means being arranged to monitor said current-voltage characteristic.
- 3) A device as claimed in claim 1, comprising a light emitter
15 element and a photodetector element, both integrated on said substrate.
- 4) A device as claimed in claim 3, in which said light emitter element and/or said photodetector element comprises a resonant cavity element in the form either of an LED or a laser.
- 20 5) A device as claimed in claim 3 or 4, in which said photodetector element is arranged to detect light of a different wavelength from the light emitted by said light emitter element.
- 6) A device as claimed in claim 5, in which said
25 photodetector element is arranged to respond preferentially to said different-wavelength light and is relatively non-responsive to light of the wavelength emitted by said light emitter element.

- 7) A device as claimed in claim 6, in which said photodetector element is provided with a wavelength-selective filter layer, at or adjacent its light-receiving surface.
- 8) A device as claimed in claim 7, in which said photodetector
5 element comprises a resonant cavity and said filter layer is provided in an upper reflector of said photodetector element.
- 9) A device as claimed in claim 8, in which said semiconductor substrate comprises said resonant cavity between upper and lower reflectors, a region of said upper reflector being
10 removed to form said emitter element, another region of said substrate forming said photodetector element and including said filter layer in its said upper reflector.
- 10) A device as claimed in any one of claims 3 to 9, in which said photodetector element comprises a diode arranged for a
15 reverse bias applied to it to place said diode close to its breakdown point so that, in use, avalanche photo-detection occurs.
- 11) A device as claimed in claim 1, comprising a resonant cavity light emitting device, a reflector thereof, through which light
20 is emitted, comprising a plurality of alternating layers of high and low refractive index material, a layer of absorbing material being incorporated into or associated with said reflector, said absorbing layer serving to absorb light of a wavelength different from the light emitted by the device.
- 25 12) A device as claimed in claim 1, comprising a resonant cavity light emitting device, having a secondary optical cavity disposed over a light-emitting surface thereof, to form a coupled-cavity system, said secondary optical cavity including a chamber or flow duct for a sample.

13) A device as claimed in claim 12, in which a reflector of said substrate, through which light is emitted, comprises a plurality of alternating layers of high and low refractive index material, a layer of absorbing material being
5 incorporated into or associated with said reflector, said absorbing layer serving to absorb light of a wavelength different from the light emitted by the device.

14) A device as claimed in claim 11 or 13, in which said absorbing layer is disposed in an undoped semiconductor region
10 of said substrate.

15) A device as claimed in claim 14, in which said absorbing layer is disposed between two groups of alternating high and low refractive index materials which form said reflector through which said light of the device is emitted.

16) A device as claimed in any preceding claim, comprising an array of light emitter/detectors integrated on a common said substrate, arranged to operate independently of each other and with said monitoring means arranged for monitoring a said characteristic of each said emitter/detector independently of
20 the others.

17) A device as claimed in claim 16, in which said emitter/detectors are arranged in a linear array.

18) A device as claimed in claim 16, in which said emitter/detectors are arranged in a two-dimensional array.

19) A device for the analysis or testing of a biological or other sample, the device comprising a single light emitter for directing light onto said sample, and a single photodetector
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for receiving light from said sample.

20) A device as claimed in claim 19, in which said light emitter and photodetector are mounted side-by-side and arranged for said sample to be positioned over them.

5 21) A device as claimed in claim 20, further comprising a carrier substrate for said sample, positioned permanently or removably over said light emitter and photodetector.

22) A device as claimed in any one of claims 19 to 21, in which said light emitter has an emission peak at one wavelength and
10 said photodetector has a light-absorbing peak at a different wavelength.

23) A device as claimed in claim 22, in which said photodetector is arranged to detect fluorescent emission from said sample, stimulated by light incident on said sample from
15 said emitter.

24) A device as claimed in any one of claims 19 to 23, in which said light emitter and/or said photodetector comprises a resonant cavity device.